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# Frequency of Cataract in Iran: A Meta-Analysis and Systematic Review

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## Abstract:

**PURPOSE:** Cataract is the leading cause of blindness and the second cause of low vision in the world. In the world, Asia has the highest number of blind population. The aim of the present systematic review and meta-analysis was to assess the frequency of clinical cataracts in Iran.

**MATERIALS AND METHODS:** The frequency of clinical cataract was defined based on the international criteria and the measured outcome of the disease. Study selection, data extraction, and quality assessment were performed by two independent reviewers. We explored PubMed, Google Scholar, ISI Web of Science, and national databases (scientific information database, Magiran) to evaluate the clinical cataract of cataract in the Iranian populations from 1995 to July 2017. Statistical analysis was performed using STATA 14.0 software.

**RESULTS:** Of 283 studies, 27 studies utilized meta-analysis. In 2017, the pooled overall frequency of clinical cataract in 59668 people was 9.27% (95% confidence interval [CI]: 8.09, 10.45,  $I^2 = 98.82\%$ ). Based on subgroup analysis, in the random effect method, the frequency of clinical cataract in males and females were 8.03% (CI: 6.78, 9.28) and 8.32% (CI: 7.08, 9.55), respectively.

**CONCLUSION:** Regarding the high frequency of clinical cataract in Iran, it seems that paying attention to the results of the current study and the application of international policy plans may contribute to better cataract control in Iran.

## Keywords:

Cataract, Iran, meta-analysis, systematic reviews

## Introduction

According to the World Health Organization (WHO), cataract is the leading cause of blindness and second cause of visual impairment in the world.<sup>[1]</sup> More than 80% of cataract patients are in low-income countries.<sup>[2]</sup> In 80% of patients, cataract is curable by surgery, but in many countries, a lot of cataract patients are blind due to low access to suitable cataract surgery service.<sup>[3]</sup> The different types of cataracts are as follows age-related cataract (senile cataract), traumatic cataract, congenital cataract,

and secondary cataract. Age-related cataract is the most common cataract in the world.<sup>[4-6]</sup> According to meta-analysis and systematic review studies, cataract is the cause of the highest percentage of blindness (41.7%–42%) in Asia.<sup>[5,6]</sup> Considering the high prevalence of cataract in Asian countries like Iran,<sup>[4]</sup> and the importance of determining a correct and evidence-based estimation of cataract prevalence in developing countries, this study evaluated the frequency of clinical cataract in Iran from 1990 to 2017. Another reason for conducting this study is due to the imposition of a large portion of health budget for cataract treatment and to help policymakers in eliminating

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cataract, which is one of the six important eye burden diseases according to VISION 2020: The right to sight program.<sup>[7]</sup> Iran has a population of 80 million and is located in the eastern Mediterranean region in West Asia and consists of 31 provinces.

## Materials and Methods

### Eligibility criteria

The methods adopted for this systematic review have been developed in accordance with the guidelines detailed on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses.<sup>[8]</sup> Observational studies (cross-sectional, case-control, and cohort) were included in present study. Case series, case reports, clinical trials, and reviews (systematic review and narrative reviews) were excluded from the study. The target populations were general populations, patients with eye disease and children. The frequency of clinical cataract was measured in this study. Cataract defined as clouding of the lens of the eye which prevents clear vision.<sup>[9]</sup> Minimum required sample size was  $\geq 25$  patients.

### Search strategy and databases

Literature review was done using the medical subject headings and keywords related to cataract frequency in Iran. We explored the electronic databases including international databases (MEDLINE [PubMed interface], Google Scholar and ISI Web of science [web of science interface]) and national databases (scientific information database [SID] and Magiran), National key journal (Journal of Current Ophthalmology) for relevant studies. No settings and language limits were imposed on the search. The specific search strategies were created by a health sciences librarian with expertise in systematic review searching. PRESS standard used for creating the search strategy.<sup>[10]</sup> The MEDLINE search strategy was adopted to search in another databases. Moreover, PROSPERO searched for the ongoing or recently completed systematic reviews. Keywords that used in search strategy were cataract, prevalence, frequency, incidence, population and Iran that were combined with Boolean operators included AND, OR, and NOT.

### Study selection

The Endnote software was used to upload the literature review results. The team developed the test screening questions and forms for Level 1 and 2 assessments based on the inclusion and exclusion criteria. Citation abstracts and full-text articles were uploaded by screening questions to the Endnote. Before the formal screening process, a calibration exercise was undertaken to pilot and refine the screening questions. The formal screening process of titles and abstracts were conducted by two researchers according to the eligibility criteria, and the consensus

method was used for solving controversies among the two researchers. The full text was obtained for all titles that meet the inclusion criteria. Additional information was obtained from the study, to resolve queries regarding the eligibility criteria. We recorded the reasons for the exclusion criteria. Neither of the review authors was blinded to the journal titles or to the study authors or institutions.

### Data extraction and quality assessment

Extracted data items included the general information (authors, title, source, and year of publication), study characteristics (study design), participant characteristics (demographics, sample size), and outcome measures (frequency of cataract). The tool of Hoy *et al.* was used for assessing the quality of studies.<sup>[11]</sup> This decision was made independently by two review authors based on the criteria for judging the risk of bias, in case of any disagreement, the consensus method was used to resolve any controversies.

### Data synthesis

All the eligible studies were included in the synthesis after a systematic review. Data were combined with the forest plot. The overall frequency of clinical cataract was estimated by the random-effects model. The heterogeneity of the preliminary studies was evaluated with I<sup>2</sup> tests. Subgroup analysis was conducted to diagnose the heterogeneity based on the kind of study participants, sex, and age. Meta-analysis was performed using the STAT 14 Statistics software (StataCorp, Texas, USA).

## Results

### Study selection

A total of 283 articles were retrieved from the initial search in different databases. Out of 261 nonduplicated studies in the title and abstracts screening process, 203 studies were excluded due to unrelated titles. Of 58 studies, 27 studies met the eligibility criteria. Of the 31 excluded studies, six studies were review, three studies were study protocol, five studies were letter to editor, four studies did not have full text, and 13 studies could not meet the least quality requirement for inclusion in the study. The list of studies is available at [http://uploadboy.me/q5u7148ao4ld/list of final included papers.pdf.html](http://uploadboy.me/q5u7148ao4ld/list%20of%20final%20included%20papers.pdf.html) [Figure 1].

### Study characteristics

These studies were conducted on 59668 patients in 22 years, the mean age of the participants was 48.8 years and most of them were female ( $n = 33923$ ; 56.8%). Of the 27 included studies, 26 studies provided only cross-sectional data, one study provided only retrospective descriptive data. Studies were conducted only in 12 out of 31 provinces in Iran. Most studies were carried out in Tehran province ( $n = 9$ ). Most studies

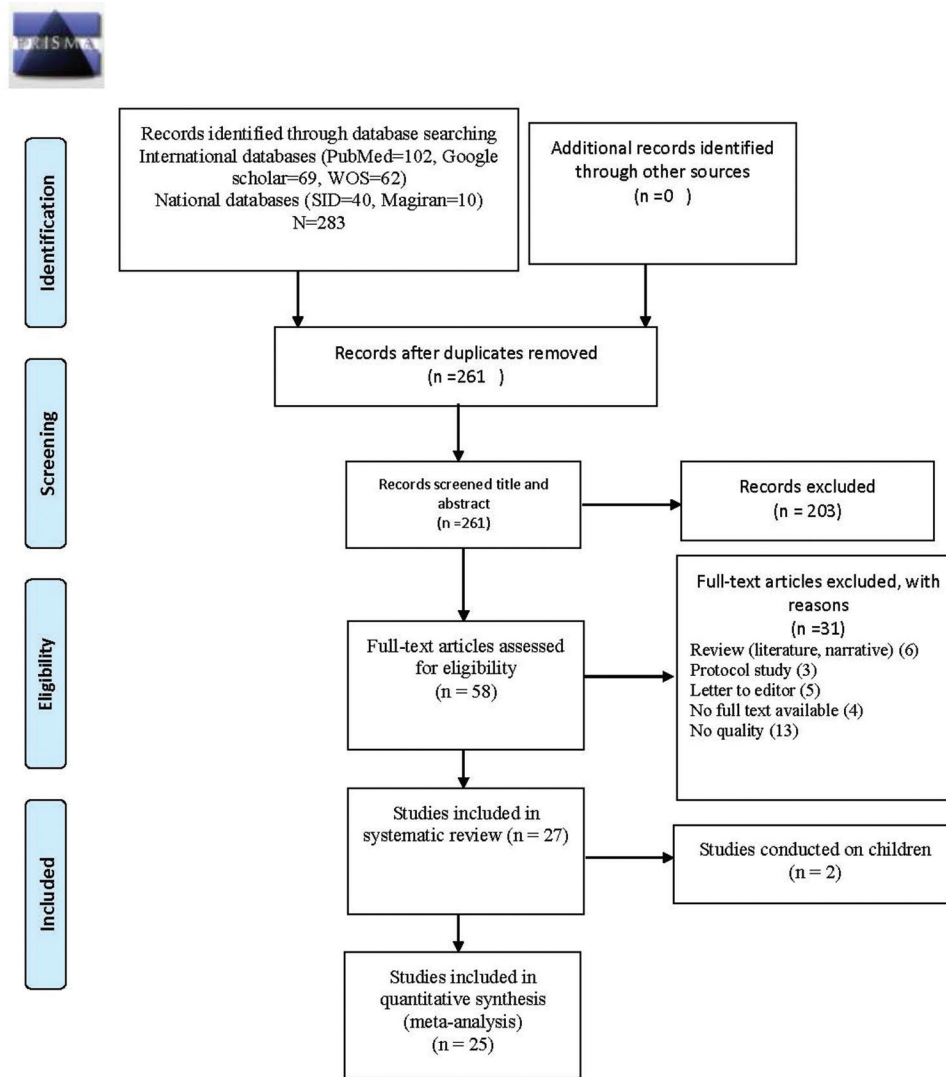


Figure 1: Flow diagram of article selection process

were conducted in hospitals ( $n = 12$ ), utilized a cluster sampling method ( $n = 12$ ), had low risk of bias ( $n = 21$ ), and was conducted in a period of 1 year ( $n = 14$ ) [Table 1].

### Meta-analysis frequency of clinical cataract

Based on the results of the random-effect method, the overall frequency of clinical cataract in 59668 people was 9.27% (95% confidence interval [CI]: 8.09, 10.45,  $I^2 = 98.82\%$ ). Subgroup analysis was conducted for the diagnosis of heterogeneity based on the kind of study participants, sex, and age.

The frequency of clinical cataract was about three times more in people with vision problems compared to those without; such that the pool estimated (in random model) frequency of clinical cataract in people without and with vision problems were 7.00% (95% CI: 5.72, 8.27,  $I^2 = 98.92\%$ ) and 16.44% (95% CI: 11.15, 21.73,  $I^2 = 98.16\%$ ), respectively [Figure 2].

Based on subgroup analysis using the random-effect method, the frequency of clinical cataract in males and females were 8.03% (95% CI: 6.78, 9.28,  $I^2 = 97.55\%$ ) and 8.32% (95% CI: 7.08, 9.55,  $I^2 = 97.77\%$ ), respectively, and a difference was also found in the study participants subgroup [Table 2].

Based on subgroup analysis using the random-effect method, the frequency of clinical cataract in the study with participants of mean age >50 years and <50 years were 16.82% (95% CI: 12.71, 20.94,  $I^2 = 99.5540$ ) and 4.92% (95% CI: 3.98, 5.86,  $I^2 = 98.82\%$ ).

### Discussion

Cataract is the major cause of blindness in the world, and its prevalence rate increased in the last decade. The present systematic review study includes cross-sectional and retrospective descriptive studies on the frequency of clinical cataract over the past 22 years which were

**Table 1: Summary of Studies characteristic**

ID	Author (year)	Province	Sampling method	Design	Setting	Sample size	Age	Study duration	Risk of bias	Target population
1	Abdollahi <i>et al.</i> (2001) <sup>[12]</sup>	Tehran	Census	Cross-sectional	Hospital	150	16.3	4 months	Moderate	All ages
2	Aghadoost <i>et al.</i> (2006) <sup>[13]</sup>	Esfahan	Census	Cross-sectional	Hospital	420	58/5	1 year	Low	All ages
3	Akhgary <i>et al.</i> (2014) <sup>[14]</sup>	Tehran	Census	Cross-sectional	Hospital	204	45.2	1 year	Moderate	All ages
4	Besharati <i>et al.</i> (2006) <sup>[15]</sup>	Yazd	Census	Cross-sectional	Welfare center	109	24.6	9 months	Low	All ages
5	Faeze <i>et al.</i> (2016) <sup>[16]</sup>	Gilan	Purposive sampling	Retrospective	Hospital	180	67.7	1 year	Low	All ages
6	Fegghi <i>et al.</i> (2009) <sup>[17]</sup>	Khuzestan	Cluster sampling	Cross-sectional	Health center	6970	24.7	1 year	Low	All ages
7	Fotouhi <i>et al.</i> (2004) <sup>[18]</sup>	Tehran	Cluster sampling	Cross-sectional	Private eye clinic	4565	30.1	1 year	Low	All ages
8	Hashemi <i>et al.</i> (2012) <sup>[19]</sup>	Semnan	Cluster sampling	Cross-sectional	Primary care center	5190	50.9	1 year	Moderate	≥ 40
9	Hashemi <i>et al.</i> (2017) <sup>[20]</sup>	Mazandaran	Cluster sampling	Cross-sectional	Health center	937	64.7	1 year	Low	≥ 54
10	Hashemi <i>et al.</i> (2015) <sup>[21]</sup>	Khorasan Razavi	Cluster sampling	Cross-sectional	Hospital	2452	31.1	2 months	Low	All ages
11	Hashemi <i>et al.</i> (2017) <sup>[22]</sup>	Mazandaran, Khuzestan	Cluster sampling	Cross-sectional	Health center	3095	37.6	5 months	Low	All ages
12	Hatef <i>et al.</i> (2008) <sup>[23]</sup>	Tehran	Cluster sampling	Cross-sectional	Private eye clinic	4354	29.19	1 year	Low	All ages
13	Javadi <i>et al.</i> (2004) <sup>[24]</sup>	Tehran	Census	Cross-sectional	Health center	2160	55.1	1 year	Low	≥ 40
14	Katibeh <i>et al.</i> (2015) <sup>[25]</sup>	Yazd	Cluster sampling	Cross-sectional	Health center	2023	59.8	1 year	Low	≥ 40
15	Katibeh <i>et al.</i> (2014) <sup>[26]</sup>	Tehran	Cluster sampling	Cross-sectional	Health center	2819	58	1 year	Moderate	≥ 50
16	Khalaj <i>et al.</i> (2013) <sup>[27]</sup>	Qazvin	Simple random sampling	Cross-sectional	Hospital	446	62.9	1 year	Low	≥ 50
17	Maeiati <i>et al.</i> (2013) <sup>[28]</sup>	Ardabil	Census	Cross-sectional	Welfare center	403	33.2	7 months	Low	All ages
18	Mirdehghan <i>et al.</i> (2005) <sup>[29]</sup>	Tehran	Convenience sampling	Cross-sectional	Hospital	362	13.5	1 year	Low	Children
19	Nodehi Moghadam <i>et al.</i> (2015) <sup>[30]</sup>	Tehran	Purposive sampling	Cross-sectional	Private eye clinic	392	71.6	2 years	Low	≥ 60
20	Nowroozpoor Dailami <i>et al.</i> (2011) <sup>[31]</sup>	Mazandaran	Census	Cross-sectional	Hospital	262	29	2 years	Moderate	All ages
21	Ostadi-Moghaddam <i>et al.</i> (2007) <sup>[32]</sup>	Khorasan Razavi	Purposive sampling	Cross-sectional	School	286	14.2	4 months	Moderate	Children
22	Shahriari <i>et al.</i> (2007) <sup>[33]</sup>	Sistan V Baluchistan	Cluster sampling	Cross-sectional	Hospital	5446	31.1	1.5 years	Low	All ages
23	Sharifi (2009) <sup>[34]</sup>	Azerbaijan Sharghi	Simple random sampling	Cross-sectional	Private eye clinic	500	40.5	6 months	Low	All ages
24	Shirzadeh <i>et al.</i> (2007) <sup>[35]</sup>	Khorasan Razavi	Cluster sampling	Cross-sectional	Health center	2508	28.28	2 years	Low	All ages
25	Soori <i>et al.</i> (2011) <sup>[36]</sup>	Tehran	Cluster sampling	Cross-sectional	Hospital	11,975	27.7	1 year	Low	All ages
26	Yaqubi and Hosseini (2004) <sup>[37]</sup>	Khorasan Jonobi	Census	Cross-sectional	Hospital	523	67.2	7 years	Low	≥ 50
27	Yekta <i>et al.</i> (2013) <sup>[38]</sup>	Mazandaran	Random cluster sampling	Cross-sectional	Hospital	937	64.7	6 months	Low	≥ 55

performed on 59,668 people. According to the main results of this study, the frequency of clinical cataract in Iran is 9.27%. The results of a study by ACOSTA showed that the prevalence of cataract in Europe, USA, and Australia is very considerable from 5% to 30%.<sup>[39]</sup> The prevalence/frequency of cataract in Iran is equal to

some other Asian countries, such as Taiwan (10.7%)<sup>[40]</sup> and Singapore (9.7%),<sup>[41]</sup> and higher than countries such as Indonesia (2.2%)<sup>[42]</sup> and Nepal (5.3%).<sup>[43]</sup> This may be due to differences in the type of studies, sample sizes, and accessibility to effective eye-care services. Despite scientific advances in cataract control from 1990 to 2010,



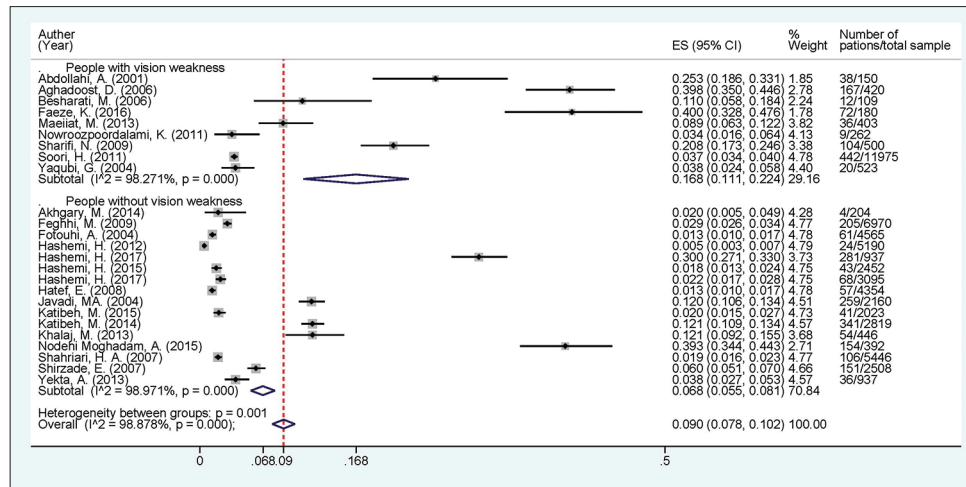


Figure 2: The frequency of clinical cataract among primary studies and frequency of clinical cataract of pooled estimate in Iran. CI: Confidence interval; ES: Effect size

Table 2: Subgroup analysis done for diagnosis of heterogeneity base on kind of study participants and sex

ID	First author	Male			Female		
		ES	95% CI for ES	Percentage weight	ES	95% CI for ES	Percentage weight
People with vision problems							
1	Abdollahi	24.77	17.00-33.96	1.59	26.83	14.22-42.94	0.71
2	Aghadoost	40.32	33.21-47.75	1.90	39.32	33.02-45.89	2.22
4	Besharati	9.59	3.94-18.76	2.00	13.89	4.67-29.50	0.97
5	Faeze	33.33	23.24-44.68	1.13	45.45	35.41-55.77	1.21
17	Maeiati	8.61	5.41-12.86	3.49	9.43	5.38-15.08	3.04
19	Mirdehghan	13.33	9.05-18.69	2.92	13.82	8.76-20.34	2.56
21	Nowroozpoor Dailami	3.06	1.13-6.54	4.09	4.55	0.95-12.71	2.78
24	Sharifi	15.60	11.57-2.37	3.11	27.52	21.71-33.96	2.36
26	Soori	3.74	3.21-4.33	4.79	3.66	3.24-4.11	5.12
27	Yaqubi	3.86	1.94-6.80	4.18	3.78	1.74-7.06	4.30
Sub-total random pooled ES		14.26	9.70-18.82	29.22	18.00	11.37-24.63	25.28
People without vision problems							
3	Akhgary	2.21	0.46-6.31	4.06	1.47	0.04-7.92	4.04
6	Feghhi	3.30	2.68-4.03	4.77	2.69	2.22-3.23	5.11
7	Fotouhi	1.10	0.68-1.68	4.80	1.51	1.08-2.05	5.12
8	Hashemi	0.41	0.19-0.77	4.82	0.5	0.28-0.83	5.15
9	Hashemi	30.57	26.28-35.14	3.06	29.48	25.52-33.68	3.35
10	Hashemi	1.62	0.98-2.52	4.75	1.87	1.2-2.77	5.06
11	Hashemi	2.23	1.51-3.16	4.74	2.18	1.54-2.97	5.08
12	Hatef	1.21	0.76-1.83	4.79	1.38	0.96-1.91	5.12
13	Javadi	12.16	10.00-14.61	4.18	11.89	10.21-13.74	4.68
14	Katibeh	2.13	1.30-3.27	4.71	1.94	1.2-2.95	5.04
15	Katibeh	12.15	10.52-13.93	4.44	12.04	10.35-13.89	4.68
16	Khalaj	13.52	9.50-18.47	3.08	10.4	6.55-15.45	3.23
20	Nodehi Moghadam	42.08	35.19-49.21	1.99	36.32	29.48-43.59	2.00
22	Ostadi-Moghaddam	10.83	6.44-16.77	2.79	13.18	7.87-20.26	2.40
23	Shahriari	1.75	1.26-2.37	4.79	2.1	1.62-2.66	5.11
25	Shirzadeh	5.03	3.77-6.56	4.57	6.69	5.48-8.08	4.89
28	Yekta	3.22	1.77-5.34	4.45	4.38	2.77-6.56	4.65
Sub-total random pooled ES		6.32	4.98-7.67	70.78	6.17	4.89-7.45	74.71
Overall random pooled ES		8.03	6.78-9.28	100	8.32	7.08-9.55	100

CI: Confidence interval, ES: Effect size

the increase in global incidence rate of cataract is 1% among men and 3% among women. It is still the most important cause of blindness and second leading cause

of visual impairment in the world.<sup>[6]</sup> Cataract accounts for >33.4% of blindness worldwide and >42% of it in Asian countries including Iran.<sup>[44]</sup> The current study reported

that its frequency was three times higher in people with eye problem than the healthy individuals. Moreover, the current study showed that the prevalence/frequency of cataract was 16.82% and 4.92% in people older and younger than 50 years, respectively.<sup>[45,46]</sup> Consistent with the results of other studies, this finding emphasizes the role of gender in this disease in different studies.<sup>[6,47]</sup> Although cataract is categorized as preventable eye disease, there are different barriers against the reduction of the incidence rate of blindness and visual impairment caused by cataract. Some of these barriers are as follows: (i) high cost of cataract treatment due to limited insurance coverage, (ii) limited knowledge of people with cataract specifically in developing countries (which present >80% of blindness), such as Iran, resulting in a lengthy delay in visiting a doctor, (iii) the lack of necessary basic structures, and (iv) unfair distribution of medical equipment and ophthalmologists across different countries.

## Conclusion

Despite the many attempts and marked progress in cataract control, this problem has continued to remain an issue in Iran and other countries. Regarding the high frequency of cataract in Iran, as the major cause of blindness worldwide, it seems that paying attention to the results of the current study and application of international policy plans, such as the WHO's VISION 2020, may contribute to better cataract control in Iran. It is also recommended to conduct a comprehensive study at the national level to measure a more accurate cataract prevalence rate across the country.

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## Conflicts of interest

There are no conflicts of interest.

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